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MEMOIRS

OF THE

GEOLOGICAL SURVEY

OF

THE UNITED KINGDOM.

Figures and Descriptions

ILLUSTRATIVE OF

BRITISH ORGANIC REMAINS.

DECADE IV.

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BRITISH FOSSILS.

DECADE THE FOURTH.

All the plates and descriptions in this Decade are devoted to fossil Echinodermata of the order *Echinoidea*.

The genera selected for illustration are *Temnechinus*, *Acrosalenia*, *Hyboclypus*, *Hemipneustes*, *Ananchytes* with its section *Holaster*, and *Cardiaster*. The geological age of the first is Upper Tertiary, of the second and third Oolitic, of the remainder Cretaceous. Several of the species are represented for the first time.

Temnechinus is a genus remarkable for its species being at present known only as fossils of the Coralline and Red Crags; it is now characterized for the first time.

The examples of *Acrosalenia* selected are both remarkable for their beauty and their very perfect condition. They are also of much interest, one on account of the rectification of its true generic position, which I have been enabled to make through the aid afforded by very perfect specimens: the other, because of the complete preservation exhibited by the specimens described of parts too often lost in fossil Echinoderms. I have appended to the descriptions of these *Acrosaleniæ* brief characters of some new species of this interesting oolitic genus.

Hyboclypus is illustrated by the finest and largest species of the genus, one discovered during the researches of the Geological Surveyors.

Hemipneustes, to which genus I unite *Toxaster*, is now for the first time authentically represented by a British example, remarkable for its novelty and for the light it throws upon the mutual affinities of those genera of *Echinoidea* which have excentric mouths.

The well known genus *Ananchytes* is combined (as indeed it was formerly by Lamarck) with *Holaster*. In selecting the common *Ananchytes ovata* of the Chalk for the subject of a plate and description, I have been influenced by the necessity of clearing up the confused synonymy of this fine fossil, and of settling the numerous spurious species which have been constituted out of its varieties, or from imperfect figures contained in old works.

Cardiaster is a new genus, lately constituted by myself for some remarkable and interesting sea-urchins, intermediate in their characters between *Ananchytes* and the true *Spatangidæ*. To the account of the species figured I have added notices of all the forms of this curious type which are known to me as British.

EDWARD FORBES.

October, 1852.

BRITISH FOSSILS.

Decade IV. Plate V.

HEMIPNEUSTES GREENOVII.

[HEMIPNEUSTES. Agassiz. (Sub-kingdom Radiata. Class Echinodermata. Order Echinoidea. Family Spatangidæ.) Body cordate, more or less tumid, in some species much elevated; ambulacra dissimilar, the lateral ones dorsally curved, petaloid or semi-petaloid, the odd one straight and lodged in a sulcus. Vent terminal supra-marginal. Mouth excentric, transverse. No fascioles. Genital pores four. Tubercles minute, perforated, placed on crenulated bosses.]

Hemipneustes Greenovii. Sp. Nov.

Diagnosis. *H. testâ tumidâ ambitu cordato; ambulacro antico poris superne dissimilaribus alternatis; ambulacris antero-lateralibus serie externo pororum angustissimo, postero-lateralibus seriebus sub-similaribus.*

This curious and rare Echinite presents characters which distinguish it very strikingly from any described species. Its characters link together the genera Hemipneustes and Toxaster, hitherto placed apart, even in different groups, the former being usually associated with *Ananchytes*, the latter with *Micraster*.

The well known *Hemipneustes radiatus* of the Maestricht Chalk is the type of its genus. In general contour it resembles an *Ananchytes*, but essentially differs in the structure of the test, for instead of the ambulacra being all similar and formed of homogeneous or nearly homogeneous parts throughout, the lateral ones are very unlike the anterior one, the former being partially petaloid, and the latter rectilinear. Its lateral ambulacra are, moreover, remarkable for being composed in their petaloid portions of differently constructed avenues, the hinder avenue of each being made up of pores widely separated and connected by a broad groove, whilst the fore one is made up of minute and closely approximated pairs of pores.

The genus *Toxaster*, on the other hand, was instituted for those heart-shaped urchins that resemble *Holaster* in general aspect, but have subpetaloid ambulacra in the manner of *Micraster*, differing, however, materially from the latter in the absence of any kind of fasciole. The depressed or slightly tumid shape of most of the known species is so very unlike that of *Hemipneustes radiatus*, that no comparison seems to have been instituted with it. Essen-

tially, however, there appears to be no generic distinction between them, for though in several Toxasters the difference between the two series of avenue pores in the lateral ambulacra is very slight and indistinct, in others it is as great as in *Hemipneustes* proper. In *Toxaster complanatus* for example the two avenues of each lateral ambulacrum are similar ; so are they also nearly but not quite in *Toxaster gibbus* (Agassiz), *T. Ricordeanus* (Cotteau), and *T. Nicœensis* (Sismonda). But in *Toxaster oblongus* (Deluc) and *T. Verany* (Sismonda) they are nearly as dissimilar as they are in *Hemipneustes radiatus ;* and in the species now to be described the antero-lateral ambulacra have dissimilar avenues, and the postero-laterals nearly similar ones. Unless the *Toxaster oblongus, T. Moulini, T. semistriatus,* and *T. Verany* be regarded as species of *Hemipneustes,* and the name *Toxaster* be confined to those species resembling *T. complanatus* in the arrangement of the pores, (in which case my new species would become the type of a new and intermediate genus,) these two groups must be considered as forming but one natural genus. Such indeed is the view that I take of the assemblage, and the name *Hemipneustes,* as the older appellation, had best be retained for it.

The *Hemipneustes Greenovii* has a regularly cordate outline truncated posteriorly. It varies greatly in degree of tumidity, but appears always to present a high apex and hinder half, whilst the portion in front of the centre declines with a gentle curve, and is divided into two tumid cheeks by the rather deep and wide but not abruptly margined central furrow. The hinder extremity is perpendicularly truncate, and bears the vent at about half the height of the back. The under surface is flattened, but very slightly convex, and rounded at the side. The mouth, which is transversely oblong, is placed in a depression very near the anterior margin, opposite to the anteal furrow.

The ambulacra require to be separately described. The odd one is one third wider than the laterals. It preserves nearly an equal width throughout, and is composed of plates which become contracted vertically throughout its upper half. Out of about 37 plates seen in each of its two series, the lower seven are square or oblong, and large. They are each perforated near their outer and lower corners by a pair of minute approximated pores. In the narrow plates above these a very curious change takes place in the avenue arrangements for the pairs of pores ; all become conspicuous, are alternately approximated, and set widely apart ; the latter pairs each consisting of a long outer pore and a short inner one. Inside

of the pores there is a very small tubercle or two on each plate, the rest of the surface being covered by minute and closely set granulations ranged in transverse rows. The antero-lateral ambulacra are undepressed and superficial, and exhibit a slight and graceful curve; they are composed of an inner series of minute and approximated pairs of pores and of an outer or hinder series, in which the pores of each pair are widely separated and unequal (the outer ones being longest), and connected by a shallow groove. There are about 30 pairs of pores in the petaloid portion of each series; the petals gradually become narrow and cease about half way down the sides. In the postero-lateral ambulacra, the petals are also plane and undepressed, but are more regularly lanceolate in shape, in consequence of the two series of pairs of pores in each being of nearly similar structure and but slightly unequal in width. There are about 18 pairs in each petaloid avenue. A few tubercles are seen upon the lateral ambulacra. On the interambulacral spaces they are much more numerous, though set well apart and much larger. They are largest on the anterior segments, where they have wide areolæ. Their interstices over the whole of the test are occupied by minute granules, which are, however, not so small or so regularly arranged as those on the odd ambulacral plates. On the under surface the tubercles are confined for the most part to the interambulacral spaces, and are especially numerous, regular, and closely set on the ovato-lanceolate post-oral space formed by the inferior portion of the hinder interambulacrum. This space exhibits a prominent caudal gibbosity. The tubercles are minute and perforated; they are elevated upon crenulated bosses. The spines are unknown.

The apical disk is small, and is composed of four perforated genital plates, the perforations of which are approximated. In the midst of them is seen the madreporiform body. A fifth genital plate is imperforate. The five ocular plates are all perforated, but very minute.

The larger of the two specimens figured measures $1\frac{4}{12}$ inch in length, the same in breadth, and one inch in height. The smaller is $1\frac{1}{12}$ inch in length, the same in breadth, and $\frac{8}{12}$ths of an inch in height.

Locality and Geological Position. The Greensand of Blackdown in Devonshire, a formation whose geological horizon is probably about the junction of the Gault and Upper Greensand, if it be not a local condition of the Gault itself. The specimens described are in the Museum of Practical Geology.

Explanation of Plate V.

Figs. 1. 2. 3. and 4. Represent various views of the more tumid variety.

Fig. 5. Is a profile of the depressed form.

Fig. 6. Ambulacral and interambulacral plates from the postero-lateral segment.

Fig. 7. Arrangement of the pores in the ambulacral avenues and structure of the apical disk.

Figs. 8. 9. and 10. Illustrations of the dispositions of the pores in the anteal ambulacrum.

Figs. 11. and 12. Primary tubercles and granules, magnified.

Note on another British species of Hemipneustes.

In lists of British fossils from the Lower Greensand a "*Spatangus complanatus*" is often mentioned, and referred to as the *Holaster* or *Toxaster complanatus* of the Neocomien of the Continent, a species upon which much stress has been laid by those geologists who have described foreign localities. In Mr. Morris's catalogue the *Holaster complanatus* is made synonymous with the *Spatangus retusus* of Lamarck and Goldfuss, and the *Spatangus argillaceus* of Phillips, which last-named fossil, judging from the figure given in the "Geology of Yorkshire," was an *Ananchytes* of the subgenus *Holaster*. The Upper Greensand of Wilts, the Gault of Speeton and Folkestone, and the Lower Greensand of Kent and Hants have been enumerated as formations in which the supposed "*Holaster complanatus*" is found. In Dr. Mantell's Medals of Creation (p. 355. lign. 84.) there is indeed a figure of "*Spatangus complanatus*, Chalk Marl, Hamsey," which, being evidently a representation of the true species of that name, might seem to imply not only that it is really British, but also that in England it is found in a very different geological position than on the Continent. But a comparison of the figures in question with those in Plate 2. of the "Echinodermes Suisses" shows that they are copies or tracings of the excellent representations of Neocomien, i.e. Lower Greensand examples, given by Agassiz in that valuable work. Probably *Holaster subglobosus* was the species intended by Dr. Mantell, and really found by him in the Chalk Marl of Hamsey. The specimens which have been mistaken for *Toxaster complanatus* in the Wiltshire Greensand were possibly my *Hemipneustes Greenovii;* those that I have seen so called from the Gault belong to more than one species of *Hemiaster*, and that from the Speeton clay was either a *Holaster* or a *Cardiaster* crushed. I have also seen examples of *Cardiaster Benstedi* marked *Spatangus complanatus* or *S. retusus.*

I can find no evidence whatsoever of the occurrence of the true *Toxaster* (i.e. *Hemipneustes*, as now redefined) *complanatus* in British strata. Very distinct sea-urchins, members of no fewer than four different genera, have been intended by that name in British lists.

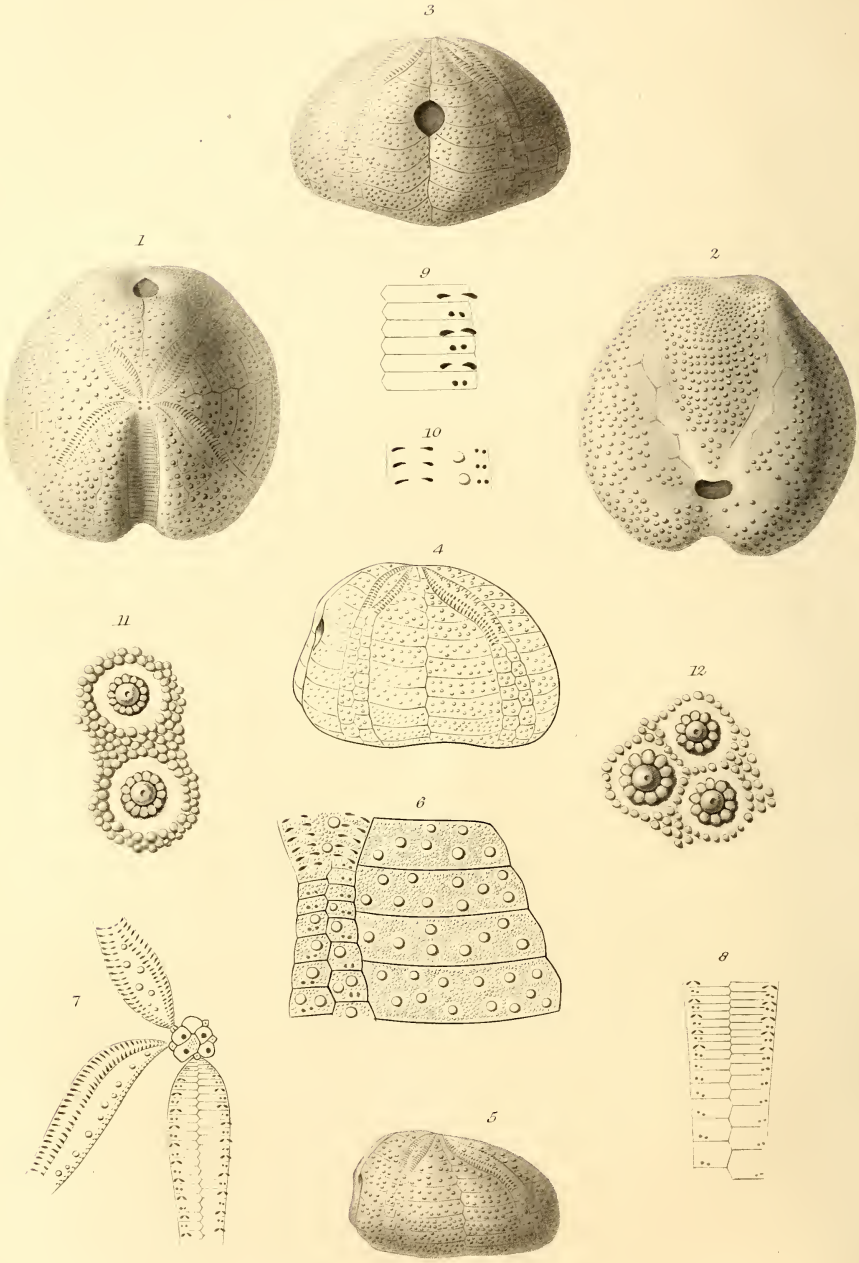
One of these, a Lower Greensand species referred to by Dr. Fitton, is really a *Hemipneustes* of the section *Toxaster*. It differs however specifically from any known species, and I have named it Hemipneustes (Toxaster) Fittoni.

It has the test tumid, ovate, depressed above, rounded inferiorly, with a shallow anteal sulcus. The lateral ambulacra are partially petaloid, and in that portion of their length lodged in very slight depressions. The avenues of pores in the odd ambulacrum are placed rather widely apart. Those of the antero-lateral ambulacra are slightly sinuous, and the outer ones are very slightly broader than the inner. There are about 36 pairs of pores in the petaloid part of each row. The postero-lateral ambulacra are much shorter and more symmetrical, and have about 16 pairs of pores in their petaloid parts of each row. The tubercles on the plates are small, pretty equal, and scattered profusely.

The dimensions of a moderately large specimen are one inch and $\frac{4}{12}$ths in length, one inch and $\frac{2}{12}$ths in breadth, and ten-twelfths of an inch in height.

In the Museum of Practical Geology is a specimen from Horseledge Point, near Shanklin, Isle of Wight, presented by Dr. Fitton, and another from Hythe, presented by Mr. H. B. Mackeson ; both from the Lower Greensand.

October, 1852. Edward Forbes.



HEMIPNEUSTES GREENOVII — *Forbes*.